PROPOSED REMEDIAL ACTION PLAN
HANNA FURNACE - SUBPARCEL 3

Environmental Restoration Project
City of Buffalo, Erie County New York
Site No. B-00164-9

November 2004

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

A 1996 Clean Water/Clean Air Bond Act
Environmental Restoration Project

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Hanna Furnace - Subparcel 3 site. The presence of hazardous substances has created threats to human health and/or the environment that are addressed by this proposed remedy.

The 1996 Clean Water/ Clean Air Bond Act provides funding to municipalities for the investigation and cleanup of brownfields. Under the Environmental Restoration Program, the State provides grants to municipalities to reimburse up to 90 percent of the eligible costs for on-site remediation activities and up to 100 percent of the costs for off-site remedial activities. Brownfields are abandoned, idled or under-used properties where redevelopment is complicated by real or perceived environmental contamination. They typically are former industrial or commercial properties where operations may have resulted in environmental contamination. Brownfields often pose not only environmental, but legal and financial burdens on communities. Under the Environmental Restoration (Brownfields) Program, the state provides grants to municipalities for site investigation and remediation activities. Once remediated the property can then be reused.

As more fully described in Sections 3 and 5 of this document, the historical disposal of fill materials (e.g. slag, cinders, demolition debris and dredged sediments) in a once marshy area, and the subsequent operations of an iron smelting facility have resulted in the disposal of hazardous substances, including heavy metals and semi-volatile organic compounds. These hazardous substances have contaminated the soils and groundwater at the site, and have resulted in:

- a threat to human health associated with current and potential exposure to contaminated soil/fill material

- an environmental threat associated with the impacts of contaminants to the surface water and sediments of the adjacent Union Ship Canal through the erosion of contaminated soil/fill material

To eliminate or mitigate these threats, the NYSDEC proposes the following remedy to allow for passive recreational use of the site:

- Surface debris would be removed, the site re-graded to required elevations, a demarcation layer placed over the site and covered with a minimum of two feet of clean soil for redevelopment of the property into a recreational greenspace.

- Soil and fill found on top of the large concrete pads located on the south side of the canal would either be removed from the site, covered in place with clean soils or removed and used as subgrade fill in other parts of the site.

- The walls of the Union Ship Canal would be repaired with the construction of an underwater berm along the base of those sections at risk of collapse.

- A shallow-water fish habitat would be created within or immediately adjacent to the Union Ship Canal, including a soil cover over the remainder of the canal bed where appropriate, as part of the repair work.

- A site management plan would be developed and implemented to address residual contaminated soils that may be excavated from the site during future redevelopment, requiring soil characterization, and where applicable, disposal/reuse in accordance with NYSDEC regulations. The plan would also identify any use restrictions (e.g. use of groundwater).

- The property owner would be required to provide an annual certification that the institutional and engineering controls put in place are unchanged from the previous certification and that nothing has occurred that would impair the ability of the controls to protect public health or the environment.

- An institutional control in the form of an environmental easement would be imposed that would: (a) require compliance with the approved site management plan; (b) limit the use and development of the property to passive recreational uses only; (c) restrict the use of groundwater as source of potable or process water, without necessary water quality treatment as determined by the Erie County Health Department; and (d) require the property owner to complete and submit to the NYSDEC an annual certification.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The NYSDEC will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The NYSDEC has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the June 2003 “Site Investigation Report and Remedial Alternatives Report (SI/RAR)”, and other relevant documents. The public is encouraged to review the project documents, which are available at the following repository:

NYSDEC Region 9
270 Michigan Avenue
Buffalo, New York
attn.: Mr. David Locey

The NYSDEC seeks input from the community on all PRAPs. A public comment period has been set from November 19, 2004 to January 3, 2005 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for December 3, 2004 at the NYSDEC office, 270 Michigan Avenue, Buffalo, NY beginning at 6:30 PM.

At the meeting, the results of the SI/RAR will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. David Locey at the above address through January 3, 2005.

The NYSDEC may modify the preferred alternative or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the NYSDEC's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Hanna Furnace property is located near Route 5 at the southern limit of the City of Buffalo (Figure 1), surrounding the eastern end of the Union Ship Canal which opens onto the Buffalo Outer Harbor. The vacant 113-acre property was divided into subparcels currently owned by Development Downtown Incorporated and the City of Buffalo.

Properties surrounding Hanna Furnace include the inactive hazardous waste disposal site known as Shenango Steel Mold (Site #915172) to the northeast, active railroad lines and wetlands to the north and east, NY State Route 5 and the former Bethlehem Steel Corporation facility to the west, and an industrial /commercial park to the south in the City of Lackawanna (Figure 2).

For redevelopment planning purposes, the Hanna Furnace property was subdivided into four subparcels (Figure 3). The facility's former railroad yard was designated as Subparcel 1. Subparcel 2 encompasses the former location of the facility's four blast furnaces and main manufacturing area. In 2004, roads, sewers and other utilities were added to Subparcels 1 and 2. Construction also began on a factory in the southeast corner of the property (Subparcel 1) which will produce PVC (polyvinyl chloride)-building materials.

Subparcel 4 is located at the northern end of the property and was the primary disposal area for the facility's waste materials including fly ash, cinders and demolition debris. This PRAP specifically addresses Subparcel 3, the 200-foot wide band of property (approximately 20 acres) owned by the City of Buffalo surrounding the Union Ship Canal.

Subparcel 3 was used primarily as the off-loading and storage area for the raw materials (i.e. iron ore, coke and limestone) used by Hanna Furnace in the production of pig iron.

There are numerous small piles of concrete/construction debris along the northwest perimeter of Subparcel 3. Two large piles of iron ore located north of the canal, one at the east end of the site and the other near the west end, were recently sold by the City as raw material and were removed from the site as this PRAP was being prepared.

The portion of the Subparcel 3 site south of the canal is occupied by an 8-acre concrete pad, estimated to be 3 feet thick. The pad was once used to store raw materials unloaded from ships in the canal. A 2 to 3-foot layer of demolition debris (concrete, bricks and gravel) and smaller piles of crushed limestone currently cover the western and central portions of the concrete pad.

The Union Ship Canal itself is not part of the Subparcel 3 site. However, sections of the canal wall are at risk of collapse thereby jeopardizing the stability of the site. As discussed later in this proposal, repair of the canal walls will be required in order to maintain the integrity of the remedy proposed for the site. In concert with the repair of the canal walls, the NYSDEC also proposes to create a shallow-water fish habitat within and adjacent to the canal, restoring a small part of the habitat lost in the industrial development of the Buffalo waterfront.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The Buffalo & Susquehanna Iron and Coal Co. constructed the first iron ore blast furnace at the site in 1902. Prior to the construction and during the development of the facility, the marshy site had been filled with several feet of fill material including fly ash, cinders and fine to coarse sands.

The facility was eventually bought and operated by the Hanna Furnace Corporation, a subsidiary of National Steel Corporation, until 1982 when the plant closed. In 1983, the property was sold to Jordan & Foster Scrap Company, which dismantled the furnaces and most of the buildings on site. Jordan & Foster filed for bankruptcy in 1986. In 1997, the City of Buffalo gained title to the property due to non-payment of taxes. Portions of the property (Subparcels 1, 2 and 4) were later transferred to Development Downtown Inc., a not-for-profit corporation. Between 2001 and 2003, the City of Buffalo completed the demolition of the blast furnaces and remaining buildings on the property.

The facility's four blast furnaces processed iron ore into pig iron ingots for other facilities in the iron and steel industry. Iron ore and other raw materials were brought to the site by ships and barges through the Union Ship Canal which was constructed between 1903 and 1905. The facility was also serviced by an extensive railroad network. Subparcel 3 was primarily used for the unloading and storage of the facility's raw materials.

3.2: Remedial History

Previous investigations at the former Hanna Furnace site have been conducted. These investigations have included the collection and analyses of soil, sediment and water samples from the Union Ship Canal and Subparcel 3 (Figure 4).. The investigations are briefly summarized below.

1979 An evaluation of the surface water quality in the Union Ship Canal and a pond in the marshy area north of the canal (Subparcel 4) was conducted (*Solid Waste Management Facility Report*, Rupley Bahler & Blake Consulting Engineers). Water samples collected from the canal contained phenols, cyanide and iron at concentrations above NYSDEC water quality guidelines.

1982 *Inactive Site Profile Report.* After the cessation of pig iron manufacturing at the facility, the Erie County Department of Environment & Planning inspected the site and recommended a site classification of "F"; indicating that little or no environmental hazard potential existed and no corrective action was warranted.

1982 Subsurface soil samples were collected by the United States Geological Survey (USGS) from several borings located on site north and east of the canal. The soils were tested for chromium, copper, iron and lead. Subsurface soils sampled from the Subparcel 3 portion of the site were found to have levels of iron and copper in excess of NYSDEC's current guidelines. With the limited data available the USGS was unable to assess the potential for contaminants to migrate from the site to the canal(*Report of Preliminary Evaluation of Chemical Migration to Groundwater and the Niagara River from Hazardous Waste Disposal Sites in Erie and Niagara Counties*, USGS, 1985).

1983 NYSDEC added the abandoned Hanna Furnace site to its registry of inactive hazardous waste disposal sites (site #915029), classifying it '2a'; indicating that there was insufficient information to properly assess the site's environmental or public health impact.

1985 A Phase I environmental site assessment was completed including a Hazard

Ranking of the site; the site scored 8.73 out of 100, below the 28.5 threshold for sites which may be considered for nomination to the Federal National Priorities List. The Phase I report recommended further investigation.

1988 Soil, sediment, surface water and groundwater samples were collected from across the entire Hanna Furnace property for the NY State Department of Transportation's *Site Characterization and Environmental Assessment* (Recra Env, 1988). In the samples collected from Subparcel 3, metals were detected above NYSDEC guidelines in the surface soils, sediment and groundwater. PCBs were found in two of the eight surface soil samples collected but only one of those two samples contained PCBs at a concentration above current NYSDEC guidelines (i.e. 1.4 ppm total PCBs found, 1 ppm recommended as a cleanup objective). PCBs were also found in each of the three sediment samples collected from the canal but the concentrations, ranging from 0.38 to 0.65 ppm, were again below current NYSDEC cleanup guidelines. No PCBs were detected in the subsurface soils or in the groundwater. Two pesticides, aldrin and heptaclor, were the only organic compounds found in the groundwater at concentrations exceeding water quality guidelines. Lead and cyanide concentrations, each in two separate samples, also exceeded water quality standards.

1994 Numerous soil, groundwater, sediment and surface water samples were collected from the Hanna Furnace property and neighboring Shenango Steel Mold site (*Preliminary Site Assessment*, ABB Environmental Services, November 1995). However, only one subsurface soil and one groundwater sample were collected from the Subparcel 3 area. One SVOC was found in the groundwater at a concentration exceeding water quality standards. No PCBs were detected in the soil and no VOCs were found at concentrations exceeding criteria. Metals (including arsenic, iron, lead and zinc) were detected at concentrations exceeding the applicable guidelines in samples collected from soil and groundwater.

1997 An *Environmental Site Assessment* report (Ecology & Environment Inc., May 1997) for the City of Buffalo summarized previous investigations with the object of identifying potential areas of concern.

1999 Sediment samples were collected by the US Army Corps of Engineers (USACOE) from the length of the canal (*Final Report for Sediment Sampling and Chemical Analysis at the Union Ship Canal*, Padia Environmental, January 2000).

2001 Sediment from the canal was sampled as part of the investigation of the nearby Shenango Steel Mold site (*Remedial Investigation/Feasibility Study Report*, Environmental Resource Management, January 2002). The sampling focused on the outfall of a storm sewer at the northeast corner of the canal. The samples, analyzed only for PCBs, indicated contaminant levels were highest near the outfall and decreased with distance from the outfall.

2001 USACOE conducted a structural and stability analyses of the canal walls (*Structural Analysis- Union Ship Canal,* USACOE, Nov. 2002) with diver inspections, test pits and concrete corings. Search pattern dives found fifteen submerged vehicles, several vehicle parts and various other miscellaneous debris along the length of the canal bottom. The canal walls were found to be constructed on top of shale bedrock, consisting of timber cribbing supporting concrete caps. The study found that the northeast section of the canal wall did not meet stability criteria. This section showed signs of distress and previous attempts at repair (i.e. the concrete caps had been removed). USACOE concluded that failures in this section of wall would be progressive unless stabilization methods were undertaken. Four stabilization methods were examined, two involved the construction of berms submerged at the base of the damaged walls to provide support, the other two options would have the eastern end of the canal completely filled in with rock, sand and/or soil. USACOE recommended the construction of a 1400-foot submerged sand berm along the base of the canal wall. Total cost for this stabilization method was estimated to be $1.7 million.

The neighboring Subparcels 1 and 2 were also the subject of separate environmental investigations under NY State's Voluntary Cleanup Program between 1999 and 2001. The investigations found the soil and fill material on both sites were contaminated with semi-volatile organic compounds and heavy metals. Plans call for redeveloping both parcels into an commercial/industrial park. Remediation will be accomplished by covering the sites with either a layer of clean soil, a minimum of 12 inches thick, or pavement as the redevelopment proceeds. The first phase of redevelopment is underway with the construction of an access road and installation of water, sewer, gas and electric utilities.

Subparcel 4 was also investigated as part of the same 1988 and 1994 Hanna Furnace studies mentioned earlier and again in 2000 by the USEPA. The investigations focused on the two large mounds of flue ash and furnace demolition debris which dominate the site. The contaminant concentrations found in both of the fill types were generally consistent with what was found in the other subparcels. A notable exception was lead; the concentrations found in the flue ash were higher than the site specific action levels approved for Subparcels 1 and 2. One of several ash samples tested by the Toxicity Characteristic Leachate Procedure (TCLP) exceeded the hazardous waste threshold for lead.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past owners and operators, waste generators, and haulers.

Since no viable PRPs have been identified, there are currently no ongoing enforcement actions. However, legal action may be initiated at a future date by the state to recover state response costs should PRPs be identified. The City of Buffalo will assist the state in its efforts by providing all information to the state which identifies PRPs. The City will also not enter into any agreement regarding response costs without the approval of the NYSDEC.

SECTION 5: SITE CONTAMINATION

The City of Buffalo has recently completed a site investigation/remedial alternatives report (SI/RAR) to determine the nature and extent of any contamination by hazardous substances at this environmental restoration site.

5.1: Summary of the Site Investigation

The purpose of the SI was to define the nature and extent of any contamination resulting from previous activities at the site. The SI was conducted between June 2001 and March 2003. The field activities and findings of the investigation are described in the SI report.

The following activities were conducted during the SI:

- Research of historical information;
- Excavation of eighteen test pits for analysis of soils,
- Installation of sixteen soil borings and seven monitoring wells for analysis of soils and groundwater as well as physical properties of soil and hydrogeologic conditions;

- Sampling of nine new and existing monitoring wells;

- To determine whether the soil and groundwater contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on NYSDEC "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels".

- Sediment SCGs are based on the NYSDEC "Technical Guidance for Screening Contaminated Sediments."

Based on the SI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized below. More complete information can be found in the SI report.

5.1.1: Site Geology and Hydrogeology

The naturally occurring soils at the site consist of a light to dark gray, clay to silty clay unit of variable thickness (one to eight feet) overlying a water-bearing, gray to brown sandy peat unit (two to eight feet thick). A gray, silty sand occurs intermittently throughout the site beneath the sandy peat. The silty sand is also of variable thickness (one to five feet). Underlying the silty sand is a basal silty clay unit, which in turn is underlain by a dense glacial till composed of cobbles, gravel, sand and silt-sized material. The till is underlain by shale bedrock.

Pre-development topographic maps, circa 1901, show the overall area of the Hanna Furnace property as a lake margin marsh. Post-development aerial photos from 1926 show the area north of the canal (i.e. Subparcel 4 and the northern half of Subparcel 3) remained a marsh, bordered by railroad tracks that ran along the north retaining wall of the canal and looped around the marsh to the north. Aerial photos indicate that sometime between 1926 and 1965, backfilling of this marsh began and by 1994 the marsh had been completely backfilled. Maps and the 1926 aerial photo show the portion of the site south of the canal to be occupied by a concrete ore-storage pad.

The northern, eastern and southern portions of the Subparcel 3 site can be divided and characterized on the basis of the fill materials encountered during the investigation. In general, the western end of the northern portion (i.e. north of the Union Ship Canal) is backfilled with reworked natural material, possibly from construction of the canal. The southern portion consists of relatively undisturbed natural soils beneath the concrete ore storage pad. The eastern portion of the site and the east end of the northern portion are both characterized by an abundance of industrial fill materials. The industrial fill materials typically include slag, limestone, cinders, ash, concrete, wood, plastic, rubber and metal debris.

It was expected that groundwater in the site soils would be encountered at a level proximate to that of the water in the canal, typical of a hydrologic system which allows free interchange. However, in the northern and eastern portions of the site the groundwater was typically found 5 to 7 feet above the level of the canal. The groundwater elevations in these areas also varied significantly over relatively short distances, sometimes less than 50 feet. The SI report surmised that the variation in groundwater depths across the site could be the result of a number of factors including variation in the porosity and transmissivity of the different fill materials, localized ponding of the groundwater, and variations in the permeability of the concrete retaining walls of the canal.

In the southern portion of the site, groundwater was encountered directly beneath the concrete pad. The concrete pad lies approximately 5 feet below the surrounding terrain, and as noted above it is approximately 3 feet thick. The groundwater lies only 0.5 to 3.2 feet above the water level of the canal, suggesting that there may be a greater degree of interchange of groundwater and canal water than what may be occurring in the areas of the site north and east of the canal.

5.1.2: Nature of Contamination

As described in the SI report, many soil, and groundwater samples were collected to characterize the nature and extent of contamination (Figure 5). As summarized in Table 1, the main categories of contaminants that exceed their SCGs are semi-volatile organic compounds (SVOCs) and inorganics (metals).

The SVOCs of concern are certain carcinogenic (cancer-causing) polycyclic aromatic hydrocarbons (cPAHs), which include the compounds: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene and dibenzo(a,h)anthracene. PAH compounds are common constituents of fill material in urban environments. PAHs are typically associated with coal tar and asphalt-based materials and ash, and are often found in areas where fossil fuels, such as coal and heating oil have been used as energy sources. PAH compounds are generally not very soluble in water and tend to adsorb to soils. Such compounds are therefore somewhat immobile in the environment. These compounds do not readily breakdown in the environment. PAHs deposited from the combustion of coal or other fuels years ago will most likely still be present today. Because of their low volatility and association with soil, the primary concern for potential exposure to PAHs include inhalation (dust), ingestion and dermal contact.

A number of metals were also detected in the site soils and groundwater at concentrations exceeding the SCGs. Like PAHs, metals are generally not very mobile in that they have low water solubilities and tend to adsorb to soil particles.

5.1.3: Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for soil samples. For comparison purposes, where applicable, SCGs are provided for each medium.

Table 1 summarizes the degree of contamination for the contaminants of concern in and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

Surface Soil (depth 0-2 inches)

The analytical data for the subsurface soils is summarized in Table 1 and presented graphically in Figure 6.

No VOCs were detected at concentrations exceeding SCGs. SVOCs, consisting primarily of polycyclic aromatic hydrocarbons (PAHs) were detected in all thirteen samples. In nine of the thirteen samples the concentrations of carcinogenic PAHs (cPAHs) exceeded SCGs. In general, these occurrences were limited to a single cPAH, either benzo(a)pyrene or benzo(a)anthracene. Exceptions were found in the northeastern portion of the site near TT-306, TT-309 and BH-304. In this area, the number of detected SVOCs was greater and the concentrations were somewhat higher. The presence of the PAHs most likely resulted from past operations of Hanna Furnace facility and the railroad network on site, and airborne deposition from other industrial facilities in the vicinity.

Various metals including arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, mercury, nickel and zinc were detected in some or all of the samples at concentrations exceeding SCGs (NYSDEC TAGM 4046).

Lead was found in one surface soil, collected from the location of monitoring well MW-305, at a concentration of 12700 ppm. In June 2004, NYSDEC sampled the soils surrounding the well and concluded that the elevated lead concentrations were confined to just the surface (0-2") soils and over a relatively small area extending 10 to 15 feet northeast from the monitoring well location. It should also be noted that the concentration of lead in the groundwater sampled from MW-305 was below the SCG.

Total cyanide was detected in one sample at a concentration of 1.7 ppm. The concentration of free cyanide (i.e. weak acid dissociable), ranging from 0.81 to 5 ppm, was found in seven of the thirteen samples. NYSDEC TAGM 4046 does not specify a recommended soil cleanup goal for either total or free cyanide. However, the USEPA has developed a preliminary remediation goal of 1,200 ppm for free cyanide in residential settings based on a direct contact exposure pathway.

Only a limited number of pesticides were detected in a few of the samples but none at concentrations exceeding SCGs. No PCBs were detected in any of the samples.

In general, contamination in the surface soils was limited to various metals across the site and cPAHs in a few areas in the northeastern portion of the site.

Subsurface Soil (depth >2 inches)

The analytical data for the subsurface soils is summarized in Table 1 and presented graphically in Figure 7.

No VOCs were detected in any of the subsurface soil samples. SVOCs, consisting primarily of PAHs, were detected in twenty one of the twenty five samples. Concentrations exceeding SCGs were observed in eight of the twenty five samples analyzed. As with the surface soils, all of these occurrences were cPAHs. Similarly, only one or two cPAHs were detected in these samples. Again, the exception was the subsurface soils in the northeast portion of the site, near BH-304 and MW-306, the same area where elevated cPAH concentrations were found in the surface soils.

The concentrations of SVOCs in the subsurface soils were generally less than or similar to the concentrations found in the surface soils. The number of compounds detected were generally less than those found in the surface. In almost all cases, the cPAHs were associated with samples collected from the fill materials, the exceptions were the few samples of native sand or peat immediately underlying the fill material.

In general, the number and concentrations of metals detected in the subsurface were similar to that found in the surface soils. Total and/or free cyanide was found in seven of the twenty six samples tested at concentrations as high as 9.9 and 1.8 ppm respectively. As noted earlier, the USEPA's preliminary remedial goal for residential soils is 1,200 ppm free cyanide.

Only a limited number of pesticides were detected in a few of the samples, none at concentrations exceeding SCGs. No PCBs were detected in any of the subsurface soil samples.

Sediments

No samples of the sediments in the canal were collected as part of this site investigation. However, samples were collected for the US Army Corps of Engineers (USACOE) in November 1999, and for the NYSDEC in July 2001 as part of the investigation of the nearby Shenango Steel Mold site. A limited number of sediment samples were also collected in earlier investigations, but the discussion below focuses on the more recent and extensive 1999 and 2001 sampling events. The analytical data for the sediments is summarized in Table 1 and presented graphically in Figure 8.

Seven metals were identified at concentrations that exceeded the severe effects level (SEL) criteria. The metals included copper, iron, lead, manganese, mercury, silver and zinc. Phenol, flourene, benzo(a)pyrene and benzo(a)anthracene were the only PAHs that exceeded the sediment SCGs. The types of metals and PAHs detected in the sediments were generally the same as those detected in the surface and subsurface soils of the site. However, the concentrations of these contaminants were typically an order of magnitude greater in the sediments than in the site soils.

Given the relatively uniform distribution of metals and PAH throughout the canal, potential sources for the contaminants could include: sediment-laden storm water runoff from the site, wind-blown dust from other industrial sites in the vicinity or sources occurring during the active use of the canal such as dust, debris, soot, ash and petroleum spilled from trains and ore-handling rigs during off-loading operations. The USACOE underwater inspection on the canal found over a dozen submerged automobiles which have also likely contributed to the PAH and metals contamination of the sediments.

Two VOCs, acetone and carbon disulfide, were detected in three of the sediment samples. However, the concentrations (3 to 26 ppb) suggest that they do not pose a significant risk to ecological receptors.

Three PCB Aroclors were detected in the canal sediments but the most frequently found was Aroclor 1260. In only four of the twenty two sediment samples collected was the 1000 ppb PCB recommended cleanup objective exceeded. The PCB contamination appeared to be localized in the area adjacent to the corrugated metal storm sewer pipe which discharges into the northeast corner of the canal.

Groundwater

The analytical data for the groundwater is summarized in Table 1 and presented graphically in Figure 9.

Groundwater samples were collected in November 2001 from seven new monitoring wells (MW-301 to MW-307) and two existing wells (MW-101 and MW-103) installed in a previous site investigation. Supplemental groundwater samples were collected from MW-101, -306 and -307 on March 2, 2003 using low-flow pumping to reduce the turbidity that had been observed in the earlier sampling event.

Acetone, a VOC and common laboratory contaminant, was detected at a concentration exceeding its SCG in only one of the samples, from MW-307, during the initial round of sampling in November 2001. A few other VOCs were detected in this and other initial round samples but none of the other VOCs were found at concentrations exceeding SCGs. The lab analysis for acetone in another sample from MW-307, collected during the the March 2003 supplemental round of sampling had to be rejected due to a quality control discrepancy. However, there were no traces of any other VOCs found in the second MW-307 sample and it was concluded that the earlier presence of acetone may have been from lab contamination.

SVOCs, consisting of phenol, 2-methylphenol and 4-methylphenol, were detected at concentrations above SCGs in five of the wells (MW-301, -302, -307, -101 and -103) sampled in November 2001 in the western half of the site. The highest concentrations of SVOCs were reported in MW-307. Resampling of MW-307 in March 2003 found detectable levels of 4-methylphenol and phenol at concentrations exceeding SCGs. However, the concentrations were significantly lower than those observed in November 2001.

Additionally, four cPAHs were detected at concentrations above the SCGs in MW-306 during the November 2001 sampling event. The March 2003 resampling showed no detectable SVOCs/cPAHs.

There were no PCBs or pesticides detected in any of the samples.

Total metals, consisting primarily of iron and sodium, were detected in all nine groundwater samples at concentrations exceeding SCGs. To a lesser extent, arsenic (MW-307), lead (MW-306), manganese (MW-305 and -306), magnesium (MW-305) were detected at concentrations exceeding the SCGs. Total cyanide was detected at concentrations exceeding the SCG in MW-101, -103 and -307. Resampling of MW-101 and -307 in March 2003 indicated that concentration of free cyanide in both samples was very low (i.e., 0.012 and 0.0071 ppm). Whereas there is no NY State water quality criteria for free cyanide, the USEPA has established a risk-based concentration of 0.73 ppm for free cyanide in drinking water. The free cyanide concentrations observed on site were significantly below this criteria.

Elevated pH levels (i.e., greater than 8.0) were observed in 6 of the 9 groundwater samples. These values ranged from 8.6 at MW-310 to 12.0 at MW-101. It is suspected that the elevated levels are due to lime and limestone used in blast furnace process and associated with the slag waste material that had been used as fill across the site.

Analysis of dissolved metals (i.e. filtered groundwater samples) indicated only sodium exceeded its SCG in all nine samples. Iron (MW-101 and -307), arsenic (MW-307), and antimony, manganese and magnesium (MW-305) exceeded SCGs in just a few of the samples.

As noted earlier, the nonporous nature of the hardened fill in the northern and eastern portions of the site and the construction of the canal walls have likely impeded the flow of groundwater to the canal. While the canal sediments have been impacted, the contaminants found there differ significantly in type and concentration from those found in the site groundwater and soils. Groundwater is therefore not considered a significant pathway for off-site contaminant migration.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the SI/RAR.

There were no IRMs performed at this site during the SI/RAR.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 5.0 of the SI report.

An exposure pathway is the manner by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population. The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

At this site, contamination exists in surface and subsurface soil and in the groundwater. For a complete exposure pathway to occur, persons would have to come into contact with soil or groundwater. Currently, the only completed point of exposure is for soil. There are no homes in the area, and businesses in the area are connected to a public water supply.

Complete pathways could occur in the future during subsurface construction activities, or by use of groundwater.

In summary, under the current site use scenario, the possibility of contact with contaminated soils exists, while the possibility of contact with contaminated groundwater is minimal and unlikely. Under the future use scenario, the potential for contact with contaminated soils and groundwater is eliminated.

5.4: Summary of Environmental Impacts

This section summarizes the existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Hanna Subparcel 3 site and the areas surrounding the site are primarily urban with commercial and industrial land use. As discussed above, the soils and groundwater at the site are contaminated with PAHs and metals. The site consists entirely of disturbed former industrial property and is largely barren. Portions of the site north and east of the Union Ship Canal contain some invasive shrub and herbaceous species colonizing these areas. The portion of the site south of the Union Ship Canal is entirely covered by the concrete of the former ore storage pads. Due to the disturbed soils and recent history of industrial use at the site, the plant community is not well developed and does not provide an important habitat for terrestrial wildlife. There are therefore no significant wildlife concerns at this site.

Fish and wildlife resources observed in the Union Ship Canal included numerous water birds. The Canal also evidently supports abundant fish; site inspections have usually observed people fishing from the edge of the Canal. The edges, shoreline and concrete walls of the Canal are generally highly disturbed and in some disrepair, and garbage and debris have been observed along the water's edge. Because of the extensive disturbance and manmade nature of the Canal, it is not likely to support a large diverse ecosystem compared to natural riparian systems. Nevertheless, the Canal provides habitat connected to and protected from the open waters of Lake Erie and appears to be attractive to a variety of fish and wildlife species as well as a resource for human recreational use.

Surface water samples collected from the Union Ship Canal during earlier investigations did not have any detectable organics, and the inorganics (metals) were below SCGs.

Given the type of contaminants found in the sediments and the relatively uniform distribution throughout the canal, potential sources for the contaminants could include: sediment-laden storm water runoff from the site; wind-blown dust from other industrial sites in the vicinity; bilge water pumped from freighters; or the dust, debris, soot, ash and petroleum from the trains and ore-handling rigs during off-loading operations when the canal was in use. The USACOE's underwater inspection of the canal found over a dozen submerged automobiles, which have also likely contributed to the contamination of the sediments. Based on the hydrogeological results of the Subparcel 3 site investigation, it does not appear that significant contaminant groundwater migration from the site to the canal is occurring.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS AND THE PROPOSED USE OF THE SITE

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous substances disposed at the site through the proper application of scientific and engineering principles.

The proposed future use for the Hanna Furnace-Subparcel 3 site is a "greenspace" or passive recreation park.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- exposures of persons at or around the site to metals and PAHs in site soils;
- the release of contaminants from surface soils into the surface water of the Union

Ship Canal through surface water runoff and transport of wind borne dust.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements. Potential remedial alternatives for the Hanna Furnace-Subparcel 3 Site were identified, screened and evaluated in the RA report which is available at the document repository identified in Section 1.

A summary of the remedial alternatives that were considered for this site are discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, and monitoring (OM&M) would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated soil at the site.

Alternative 1: No Action

Present Worth: *$0*
Capital Cost: *$0*
Annual OM&M: *$0*

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. Under this alternative no active measures would be instituted to remediate the site. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Alternative #2 Institutional Controls

Present Worth: *$216,612*
Capital Cost: *$201,240*
Annual OM&M: *$1,000*

Under this alternative, human exposure and health risks would be reduced/minimized by restricting public access and future redevelopment activities rather than by cleaning up or containing site contaminants. The Institutional Control alternative would include an environmental easement to control future redevelopment on site (i.e., restrict earthwork) and groundwater use restrictions prohibiting withdrawal of groundwater for drinking or other potable uses. The site would be fenced to restrict public access to the site.

Alternative #3 Soil Cover

Present Worth: *$1,478,355*
Capital Cost: *$1,324,631*
Annual OM&M: *$10,000*

Under the Soil Cover alternative, existing surface debris would be removed and disposed off site and the site would be graded and covered with a minimum of two feet of clean soil and seeded. A demarcation layer (e.g. filter fabric) would be placed on top of the contaminated site soil/fill materials and below the clean cover soil. A Soil Management Plan (SMP) would be developed to address any future site construction activities requiring excavations or other disturbances of the soil cover. An environmental easement and groundwater use restrictions would also be added. This alternative would prevent direct contact with contaminants and would minimize the generation and transportation of fugitive dust as well as storm water surface erosion.

Alternative #4 Removal and Disposal

Present Worth: *$21,335,755*
Capital Cost: *$21,335,755*
Annual OM&M: *$0*

Under the Removal and Disposal alternative, all surface and subsurface soils that exhibited contaminant concentrations exceeding the recommended soil cleanup objectives of TAGM 4046 would be removed and disposed off site in a permitted landfill. The excavated areas would be backfilled with clean soil to original grade. Post-excavation soil samples would be collected from the walls and floor of the excavations to confirm that residual levels of contaminants of concern are below action levels. Representative samples of the excavated soil would be collected and analyzed, and a waste profile prepared for the soil. The soil would be transported to an approved off-site landfill for disposal as either hazardous waste or non-hazardous contaminated solid waste. Once the excavated areas are backfilled, the surface would be covered with topsoil and seeded. This alternative would remove site contaminants with the soils and eliminate the direct contact hazards.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of environmental restoration projects in New York State.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

For the planned redevelopment of the site, Alternative 1 would not be protective of human health and the environment due to the presence of contaminants in the exposed surface soils. Alternative 2 would be protective of human health but not of the environment. Fencing the entire site would be inconsistent with the planned site redevelopment. Alternative 3 would be protective of human health and the environment. The soil cover would limit direct contact with contaminants in the surface soil and long term maintenance of the soil cover would prevent erosion to the surface water of the canal. Alternative 4 would be the most protective of human health and the environment by eliminating any potential direct contact with contaminated site soils and removing the source of on-site groundwater contamination and off-site impact via erosion and surface runoff to the canal.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the NYSDEC has determined to be applicable on a case-specific basis.

Alternatives 1, 2 and 3 would all fail to meet SCGs, specifically the TAGM 4046 soil cleanup objectives and the water quality standards for Class GA groundwater. Alternative 4 would satisfy TAGM 4046 by removing all soil/fill that did not meet the recommended soil cleanup objectives. Groundwater quality standards might also be achieved under Alternative 4, however, given the industrial surroundings it is unlikely that groundwater quality standards on site could be maintained over the long term. Providing a soil cover over the surface soil/fill under Alternative 3 would assure that SCGs would be achieved at the point of exposure and achieve a standard of performance similar to TAGM 4046. Given the impracticability of achieving and maintaining groundwater criteria, Alternative 3 would satisfy this threshold criterion.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

There would be little or no disturbance at the site from remedial work under Alternatives 1 and 2 and therefore no short term impacts. Alternative 4 would have the greatest short-term construction related impacts due to the large volume of contaminated material to be moved. Excavation and off-site removal of soils along with backfilling of clean soils could generate a dust nuisance for short periods of time, but this could be addressed with traditional dust control methods and monitoring. Excavation would also result in the need to control and treat groundwater that might be encountered and provide erosion control, both of which could also be addressed by engineering controls. Under Alternative 3, there would be similar concerns with short-term dust impacts during the placement of a soil cover, but to a significantly lesser degree, due to the smaller volume of material, minimal disturbance of contaminated soil/fill and less intrusive nature of the construction.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

Alternative 1 would leave contaminants on the site in the surface and subsurface soil/fill, with no controls, at concentrations which would preclude the proposed redevelopment of the site. Alternative 2 would include fencing but this control would be inconsistent with the proposed site redevelopment. Alternative 3 would require regular inspection and maintenance of the cover to maintain its effectiveness. Alternative 4 would remove and replace site fill material and provide the greatest degree of permanence and effectiveness. Both Alternatives 3 and 4 would allow for the proposed redevelopment of the site as a park.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

Alternatives 1 and 2 would offer no reduction in the toxicity, mobility or volume of the soil/fill at the site. Alternative 4 would reduce the volume and mobility of impacted soils, as well as the toxicity of the removed soil/fill relative to the site. Alternative 3 would not reduce the volume or toxicity of the site soil/fill, however, the soil cover would mitigate erosion to the canal, reducing the mobility of the contaminants to some extent.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Alternatives 1 and 2 could easily be implemented since little or no actual remedial action would be undertaken. Alternative 3 would also be easy to implement as it would require only standard construction equipment typically used in fill and grading operations. Alternative 4 would also require standard construction techniques to complete the excavation of the site soil/fill. However, given the depth of the area to be excavated, dewatering and treatment of a large volume of groundwater encountered during the excavation would be required under Alternative 4. Excavation near the walls of the canal might also require shoring, adding to the complexity of Alternative 4.

7. Cost-Effectiveness. Capital costs and operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2.

Alternative 1, the No Action alternative, would incur no costs. The costs for Alternative 2 would be minimal, however, given that this alternative would not allow for site redevelopment, it would be the least cost effective alternative. Alternative 4 would eliminate the need for any type of long-term monitoring but at a significantly higher cost in capital expenses. Alternative 3 may be the most cost effective alternative as it would allow for site redevelopment but at a significantly lower cost than Alternative 4.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the SI/RA reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the NYSDEC will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

7.3 Canal Evaluation

As noted earlier, USACOE examined the walls of the Union Ship Canal and found sections that were bowed or tilted inwards to the canal. In other sections, the concrete caps to the walls were missing, evidence that measures were taken years ago to lessen the load on an unstable wall. USACOE recommended repairs to the northeast, east and a small portion of the southwest section of the canal walls, a total of 1400 linear feet.

Several options were initially considered for repairing and stabilizing the walls. To minimize the disturbance of the surrounding contaminated soil and sediments, the use of sheet piles and stabilization berms were examined.

Because the sediment layer is thin and the silt is weak it was determined that sheet pile would have to be pinned into the bedrock. However, due to the lack of data obtained on the bedrock strength it was not certain if even pinning was a viable option. Given the great length of wall to be replaced, the sheet pile option would also be costly. It was also felt that the sheet pile might be out of character for a greenbelt, detracting from the site aesthetics.

A submerged berm of stone or sand could be placed in the canal at the base of the failing sections and on top of the contaminated sediments. The allowable slopes to the berms and therefore the quantities required would depend on the material selected. Table 3 compares the capital costs for sand and stone berms.

The USACOE report also estimated costs for the options of constructing a berm or sheet pile structure across the width of canal and completely backfilling the eastern 1200 feet of the canal where the failing walls are located. The quantities of material required would of course be much greater than providing submerged berms around just the perimeter of the canal and consequently the costs were significantly higher.

The USACOE concluded that stablilization berms were most in line with the intended use of the site as a waterfront greenbelt/park. As indicated in Table 3, the most cost effective option is the sand stabilization berm.

NYSDEC notes that previous industrial development of the Buffalo waterfront eliminated much of the area's shallow-water fish habitats. In concert with the stabilization of the canal walls, the NYSDEC also proposes to create a shallow-water environment, including a soil cover over the exposed sediments, within or adjacent to the canal. Options to explore in the site remedial design process might include removing portions the failing walls and the soils to create embayments to the canal and/or contouring the stabilization berms.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The NYSDEC is proposing Alternative #3 Soil Cover as the remedy for this site. The elements of this remedy are described at the end of this section.

The proposed remedy is based on the results of the SI and the evaluation of alternatives presented in the RAR.

Alternative 3 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. It would achieve the remediation goals for the site by reducing the public's direct contact with contaminated soils and the potential for storm water erosion of those soils to the adjacent canal.

With proper maintenance and inspection, a soil cover would be as protective as Alternative 4. Alternative 3 would also be somewhat easier to implement than Alternative 4 and, because there would be less disturbance of the soil and fill material, there would be fewer short-term concerns with dust and erosion. Though it would not reduce the volume, toxicity and mobility of the site contaminants as well as Alternative 4, given that SVOCs and metals are not very mobile, Alternative 3 would be the more cost-effective option.

The estimated present worth cost to implement the remedy is $1,478,355. The cost to construct the remedy is estimated to be $1,324,631 and the estimated average annual operation, maintenance, and monitoring costs for 30 years is $10,000.

As noted earlier, a USACOE study found that sections of the Union Ship Canal walls are at risk of collapse. To facilitate the redevelopment of the land surrounding the canal into a public greenspace, measures may have to be taken to repair and support these walls. The USACOE had recommended the construction of a submerged sand berm to support the base of the canal walls. The sand berm would also have the added benefit of providing for a shallow-water fish habitat.

A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program for the greenspace. The design program would also include an examination of the USACOE-recommended sand berm and the creation of shallow water fish habitats on or adjacent to the upland greenspace. The NYSDEC's preliminary estimate for constructing a shallow-water habitat is $0.9 million. The cost of the sand berm, with creation of a shallow water fish habitat, added to the total present worth cost of the proposed soil cover site remedy, was estimated to be $4.18 million (Table 4).

The elements of the proposed remedy are as follows:

1. Surface debris would be removed and the site graded to the required elevations for redevelopment. A demarcation layer would be placed on the final subgrade surface and the site would be covered with a minimum of two feet of clean soil. The site would be seeded to minimize erosion.

2. The concrete ore-storage pads south of the canal would be left essentially in their current condition. The soils and fill that have accumulated on top of the pads would be removed, covered with clean soils or used as subgrade fill elsewhere on site and covered with clean soil.

3. Repairs to the canal wall and construction of the sand berm will be preceded by the removal of the larger debris, such as the submerged automobiles, from the bottom of the canal.

4. Development of a site management plan to address residual contaminated soils that may be excavated from the site during

future redevelopment. A plan would require soil characterization and , where applicable, disposal/reuse in accordance with NYSDEC regulations; and identify any use restrictions (e.g. use of groundwater).

5. The property owner would provide an annual certification, prepared and submitted by a professional engineer or environmental professional acceptable to the Department, which would certify that the institutional controls and engineering controls put in place, are unchanged from the previous certification and nothing has occurred that would impair the ability of the controls to protect public health or the environment or constitute a violation or failure to comply with any operation and maintenance or soil management plan.

6. Imposition of an institutional control in the form of an environmental easement that would: (a) require compliance with the approved site management plan, (b) limit the use and development of the property to passive recreational uses only; (c) restrict use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the Erie County Health Department; and (d) require the property owner to complete and submit to the NYSDEC an annual certification.

TABLE 1
Nature and Extent of Contamination

October 2001

SURFACE SOIL	Contaminants of Concern	Concentration Range Detected	SCG[b]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs) (ppb)[a]	benzo(a) anthracene	43 - 2900	224	5 of 13
	benzo(a) pyrene	62 - 3200	61	6 of 13
	benzo(b) fluoranthene	41 - 6500	1100	2 of 13
	benzo(k) fluoranthene	42 - 2300	1100	1 of 13
	chrysene	62 - 3600	400	4 of 13
	dibenz(a,h) anthracene	76 - 620	14	4 of 13
PCB/Pesticides (ppb)[a]	endrin aldehyde	9.6 - 9.6	ND	1 of 13
Inorganic Compounds (ppm)[a]	arsenic	0.97 - 12	7.5	6 of 13
	barium	13.5 - 2020	300	1 of 13
	beryllium	0.25 - 6.2	0.16	13 of 13
	cadmium	0.79 - 17	10	2 of 13
	chromium	4.1 - 221	50	3 of 13
	cobalt	1.6 - 36.5	30	1 of 13
	copper	12.9 - 310000	25	10 of 13
	iron	9970 - 157000	2000	13 of 13
	lead	10.8 - 12700	1000	1 of 13
	mercury	0.051 - 0.28	0.1	1 of 13
	nickel	5.6 - 201	13	11 of 13
	zinc	102 - 12100	20	11 of 13

TABLE 1
Nature and Extent of Contamination (Cont'd)

October 2001

SUBSURFACE SOIL	Contaminants of Concern	Concentration Range Detected	SCG[b]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs) (ppb)[a]	benzo(a) anthracene	47 - 9200	224	5 of 27
	benzo(a) pyrene	46 - 7000	61	5 of 27
	benzo(b) fluoranthene	51 - 9500	1100	2 of 27
	benzo(k) fluoranthene	57 - 3600	1100	2 of 27
	chrysene	120 - 8900	400	4 of 27
	dibenz(a,h) anthracene	140 - 1100	14	2 of 27
	indeno(1,2,3-cd) pyrene	50 - 4800	3200	1 of 27
PCB/Pesticides (ppb)[a]	methoxychlor	41 - 41	ND	1 of 27
Inorganic Compounds (ppm)[a]	arsenic	1.2 - 39.6	7.5	11 of 27
	beryllium	0.21 - 6.1	0.16	27 of 27
	cadmium	0.53 - 31.9	10	2 of 27
	chromium	2.3 - 1170	50	3 of 27
	cobalt	1.1 - 45.3	30	2 of 27
	copper	3.7 - 1550	25	17 of 27
	iron	2250 - 455000	2000	27 of 27
	nickel	2.6 - 943	13	21 of 27
	zinc	6.1 - 3570	20	21 of 27

TABLE 1
Nature and Extent of Contamination (Cont'd)

November 1999 and July 2001

SEDIMENTS	Contaminants of Concern	Concentration Range Detected	SCG[b]	Frequency of Exceeding SCG
Semivolatile Organic Compounds (SVOCs) (ppb)[a]	benzo(a)anthracene	120 - 2460	780	14 of 22
	benzo(a)pyrene	140 - 2400	42.9	22 of 22
	fluorene	158 - 618	520	2 of 22
	phenol	120 - 220	39	2 of 13
PCB/Pesticides (ppb)[a]	aroclor 1242	43.5 - 43.5	1000	0 of 22
	aroclor 1254	44.5 - 782	1000	0 of 22
	aroclor 1260	15 - 10200	1000	4 of 22
Inorganic Compounds (ppm)[a]	antimony	0.32 - 15.7	LEL[c] -2	1 of 22
			SEL[c] -25	0 of 22
	arsenic	8.9 - 26.7	LEL[c] -6	22 of 22
			SEL[c] -33	0 of 22
	cadmium	1.1 - 7.4	LEL[c] -0.6	22 of 22
			SEL[c] -9	0 of 22
	chromium	14.6 - 70.1	LEL[c] -26	20 of 22
			SEL[c] -110	0 of 22
	copper	31.8 - 161	LEL[c] -16	22 of 22
			SEL[c] -110	4 of 22
	iron	1.46% - 10.7%	LEL[c] -2%	21 of 22
			SEL[c] -4%	17 of 22
	lead	9.9 - 883	LEL[c] -31	21 of 22
			SEL[c] -110	19 of 22
	manganese	764 - 1920	LEL[c] -460	22 of 22
			SEL[c] - 1100	13 of 22
	mercury	0.123 - 2.1	LEL[c] - 0.15	19 of 22
			SEL[c] -1.3	1 of 22
	nickel	12.9 - 47.4	LEL[c] -16	21 of 22
			SEL[c] -50	0 of 22
	silver	0.41-3	LEL[c] -1	10 of 22
			SEL[c] -2.2	3 of 22
	zinc	190-2480	LEL[c] -120	22 of 22
			SEL[c] -270	21 of 22

TABLE 1
Nature and Extent of Contamination (Cont'd)

November 2001 and March 2003

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Semivolatile Compounds (SVOCs)	phenol	3 - 210	1	5 of 9
Inorganic Compounds	antimony	13.2 - 13.2	3	1 of 9
	arsenic	7.1 - 110	25	1 of 9
	iron	519 - 17600	300	9 of 9
	lead	3 - 177	25	1 of 9
	magnesium	197 - 42000	35000	1 of 9
	manganese	1 - 439	300	2 of 9
	sodium	21200 - 156000	20000	9 of 9
	zinc	8.2 - 947	200	1 of 9
	total cyanide	3.7 - 7950	200	3 of 9
	free cyanide	7.1 - 12	730	0 of 2
Dissolved Inorganic Compounds	antimony	12.1 -12.1	3	1 of 9
	arsenic	7.5 - 110	25	1 of 9
	iron	7.8 - 3220	300	2 of 9
	magnesium	246 - 41200	35000	1 of 9
	manganese	22.2 - 409	300	1 0f 9
	sodium	21000 - 153000	20000	9 of 9

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water; ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;

[b] SCG = standards, criteria and guidance values: groundwater, drinking water, and surface water SCGs are based on NYSDEC "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code; soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum (TAGM) 4046 -Determination of Soil Cleanup Objectives and Cleanup Levels"; and sediment SCGs are based on the NYSDEC "Technical Guidance for Screening Contaminated Sediments." The sediment SCGs for SVOCs and PCB/Pesticides were derived using the lowest criterion ("Human Health/Bioaccumulation") from the guidance document and the lowest organic carbon content (6.5%.) found in the canal sediments.

[c] LEL = Lowest Effects Level and SEL = Severe Effects Level. A sediment is considered to be contaminated if either of these criteria is exceeded. If both criteria are exceeded, the sediment is severely impacted. If only the LEL is exceeded, the impact is considered to be moderate.

Table 2
Remedial Alternative Costs*

Remedial Alternative	Capital Cost	Annual OM&M	Total Present Worth
1. No Action	$0	$0	$0
2. Institutional Controls	$201,240	$1,000	$216,612
3. Soil Cover	**$1,324,631**	**$10,000**	**$1,478,355**
4. Removal and Disposal	$21,335,755	$0	$21,335,755

*The costs summarized are for the remediation of the site only, i.e. the land surrounding the Union Ship Canal.

Table 3
Canal Wall Stabilization Alternatives

Remedial Alternative	Capital Cost
1. Stone Slope Stabilization	$3.3 million
2. **Sand Slope Stabilization**	**$1.7 million**
3. Partially Filling Canal with Stone	$7.7 million
4. Sheet Pile Wall and Partial Filling of Canal	$4 million

The cost figures summarized above were derived from estimates provided in the USACOE report minus the cost for items that would be duplicated in the construction of the greenspace (e.g. clearing and grubbing the surrounding land) and/or items that were not essential elements of the canal wall repair (e.g. construction of a pedestrian walkway).

Table 4
Estimated Total Costs

Proposed Remedial Alternative	Cost
Soil Cover	$1.5 million
Sand Slope Stabilization	$1.7 million
Shallow-water Fish Habitat	$0.9 million
Total	**$4.1 million**

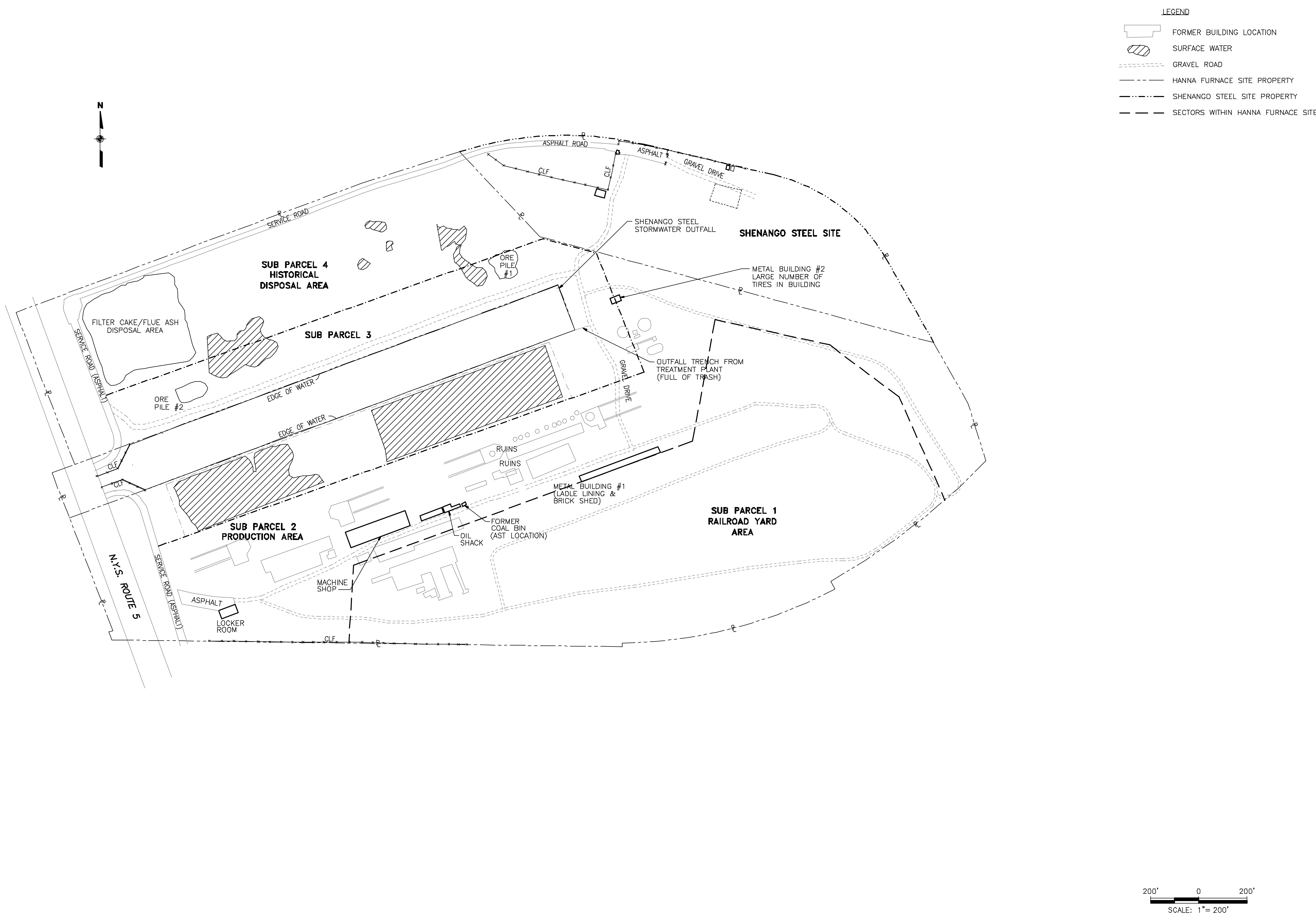
SOURCE: NYS Department of State, Division of
Coastal Resources, Digital OrthoImagery
1994-1998

2000 0 2000 Feet

URS	SITE INVESTIGATION/REMEDIAL ALTERNATIVE REPORT SUBPARCEL 3 -FORMER HANNA FURNACE SITE SITE LOCATION MAP	FIGURE 1

J:\35933.00\db\Gis\hanna.apr SITEPLAN
3/13/2002

FIGURE 2 – HANNA FURNACE SUBPARCEL 3



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WARNING
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NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION

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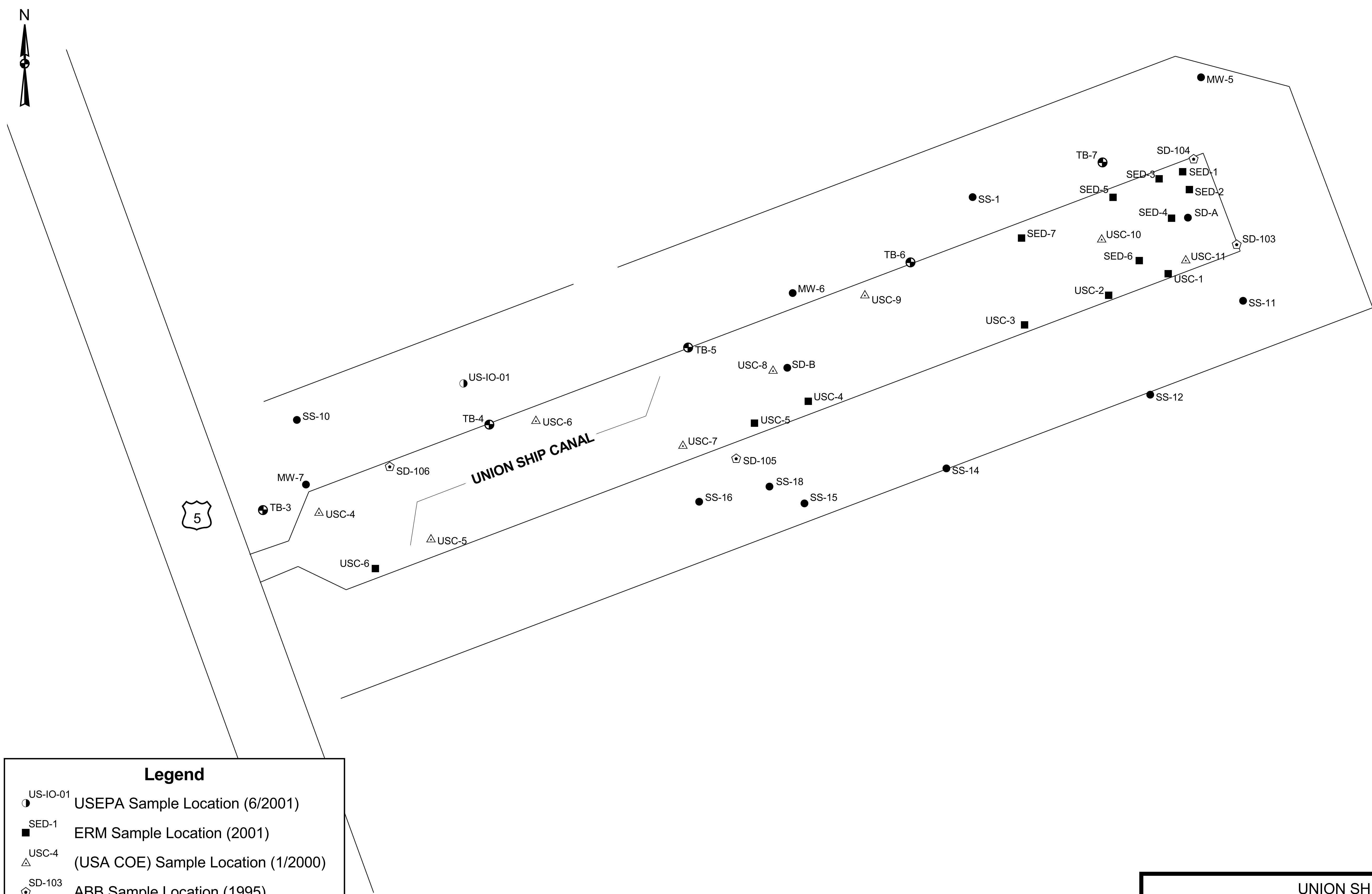
HANNA FURNACE

BUFFALO NEW YORK

FIGURE 3

HANNA FURNACE/SHENANGO STEEL MOLDS SITE PLAN

Scale: AS SHOWN



Legend

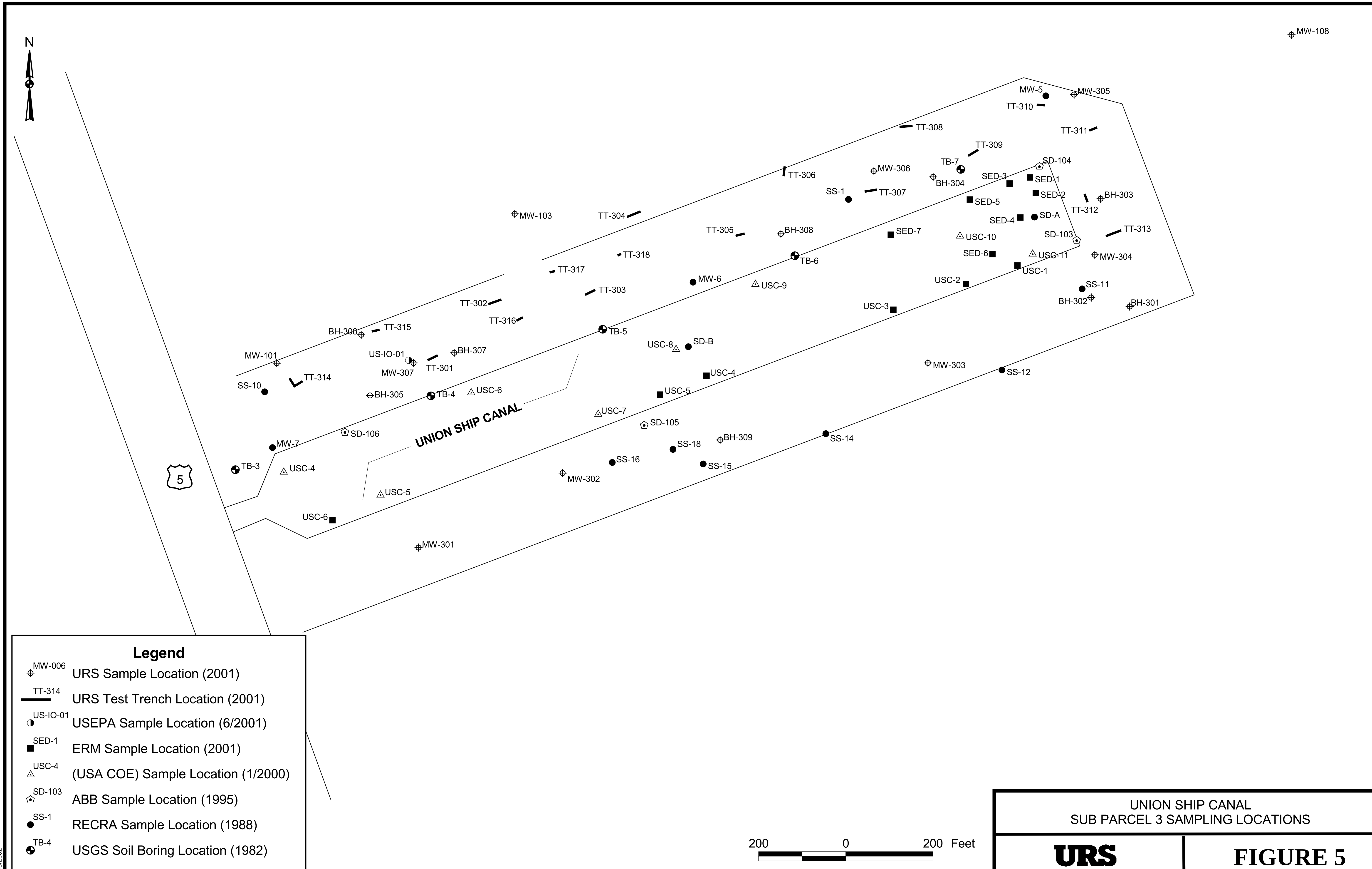
- US-IO-01 USEPA Sample Location (6/2001)
- SED-1 ERM Sample Location (2001)
- USC-4 (USA COE) Sample Location (1/2000)
- SD-103 ABB Sample Location (1995)
- SS-1 RECRA Sample Location (1988)
- TB-4 USGS Soil Boring Location (1982)

UNION SHIP CANAL
SUB PARCEL 3 PREVIOUS INVESTIGATION'S
SAMPLING LOCATIONS

URS

FIGURE 4

J:\35933.00\db\Gis\union.apr NON URS SAMPLING LOCATIONS
10/8/2002



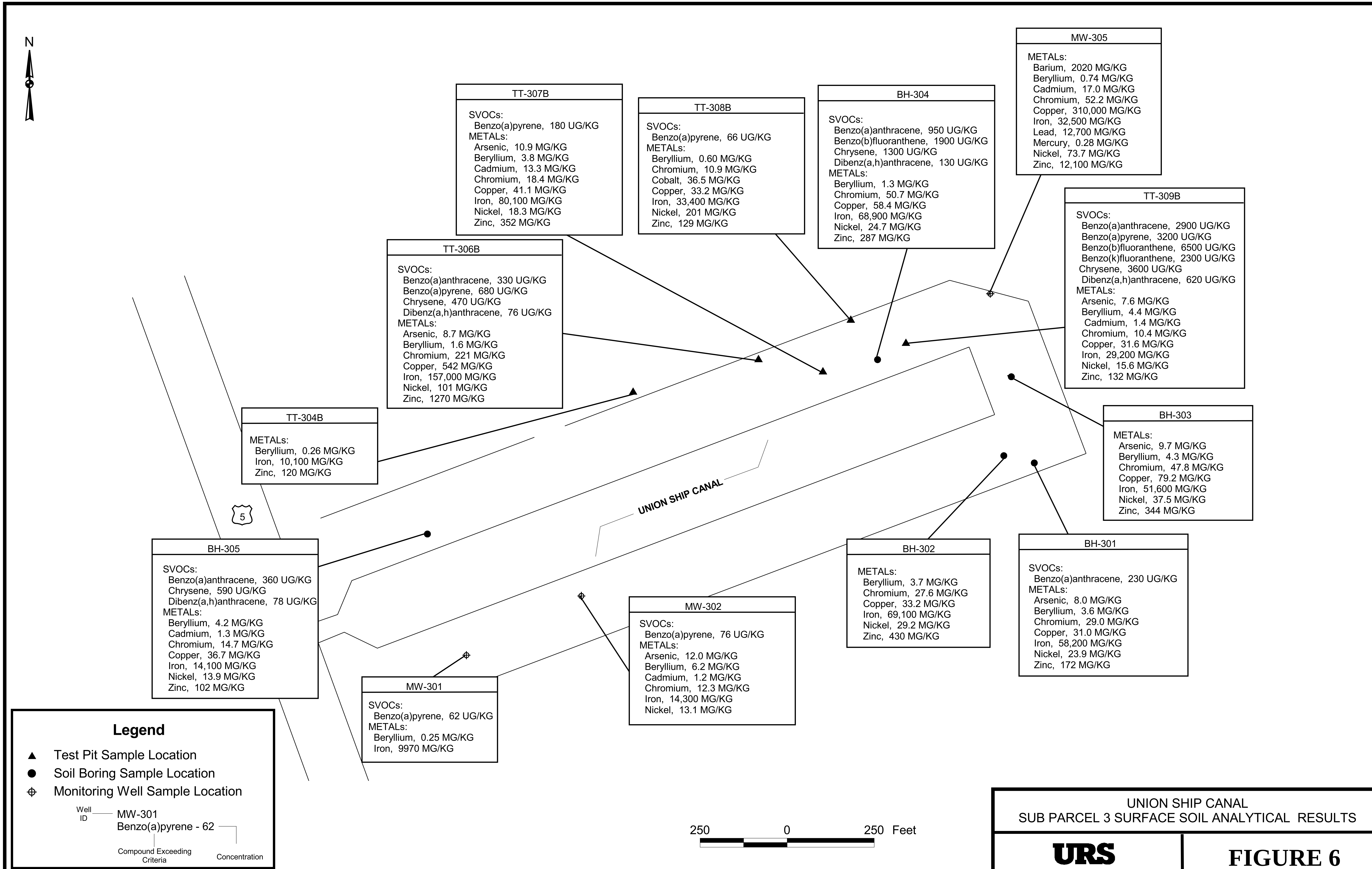
UNION SHIP CANAL
SUB PARCEL 3 SAMPLING LOCATIONS

URS

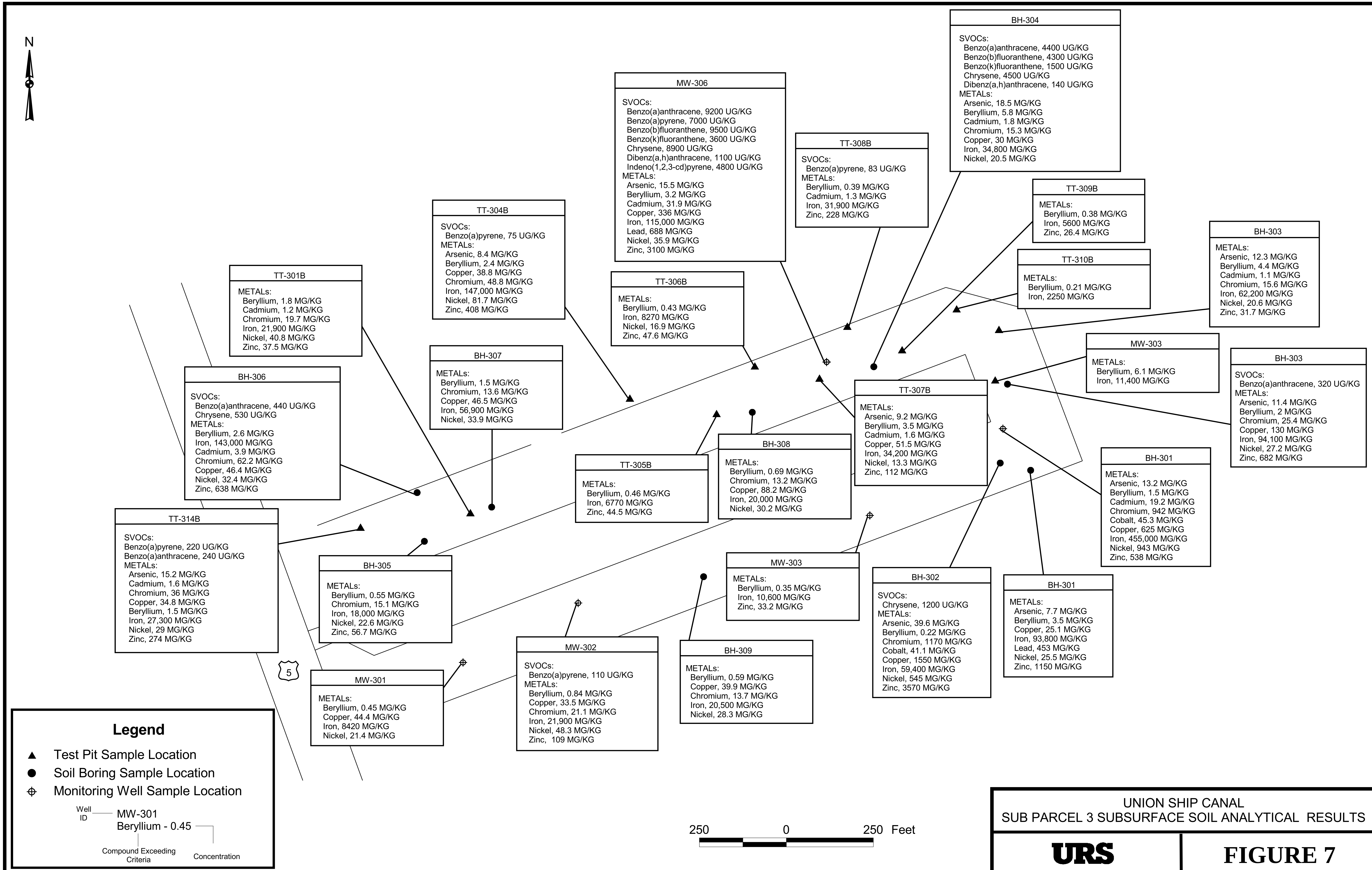
FIGURE 5

J:\35933.00\db\Gis\union.apr ALL SAMPLING LOCATIONS
10/9/2002

J:\35933.00\db\Gis\union.apr SURFACE SOIL EXCEEDANCES
4/26/2004



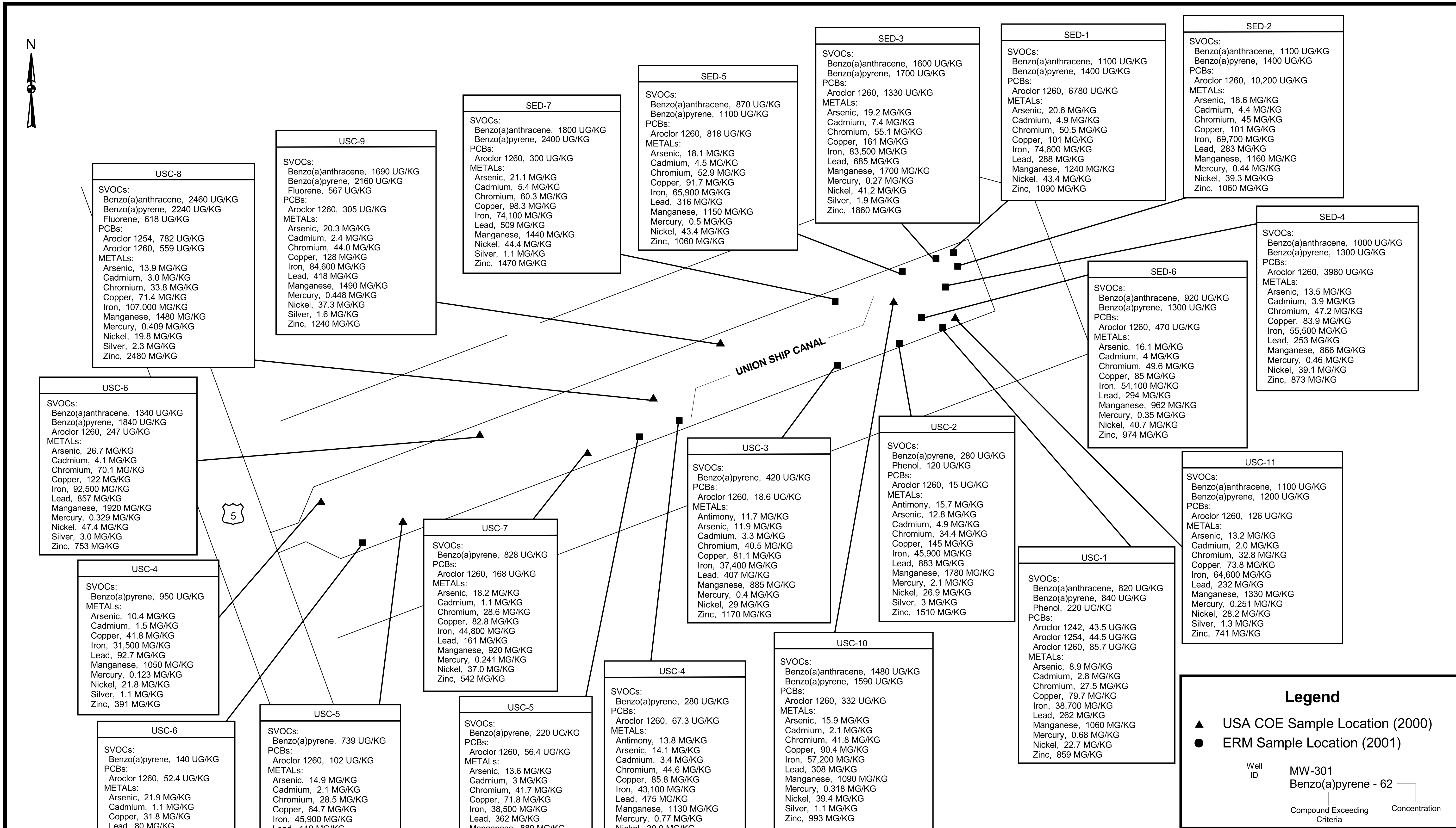
J:\35933.00\db\Gis\union.apr SUBSURFACE SOIL EXCEEDANCES
4/26/2004



UNION SHIP CANAL
SUB PARCEL 3 SUBSURFACE SOIL ANALYTICAL RESULTS

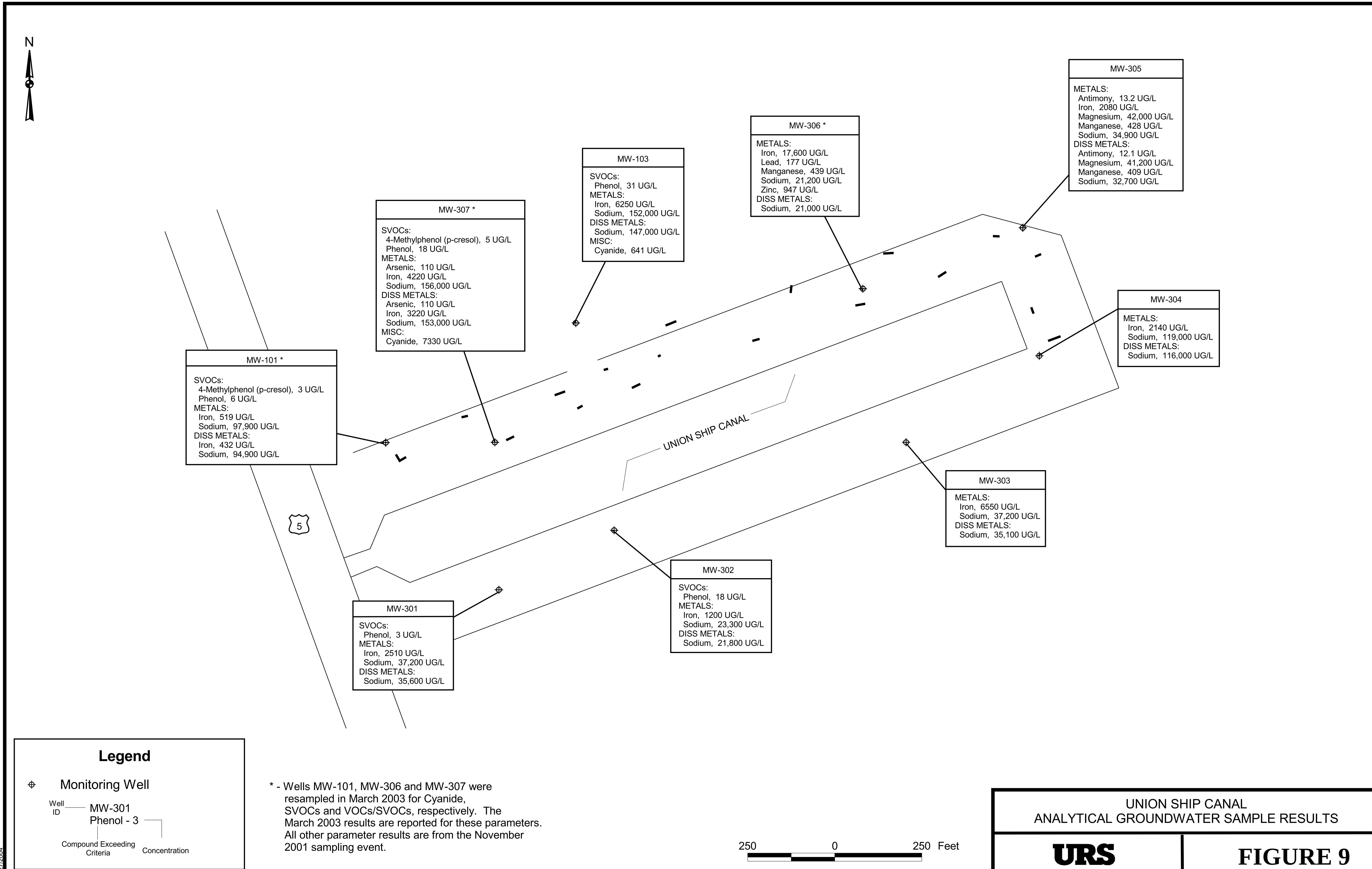
FIGURE 7

J:\35933.00\db\Gis\union.apr SEDIMENT EXCEEDANCES
4/27/2004



UNION SHIP CANAL
SUB PARCEL 3 SEDIMENT ANALYTICAL RESULTS

FIGURE 8



* - Wells MW-101, MW-306 and MW-307 were resampled in March 2003 for Cyanide, SVOCs and VOCs/SVOCs, respectively. The March 2003 results are reported for these parameters. All other parameter results are from the November 2001 sampling event.

UNION SHIP CANAL
ANALYTICAL GROUNDWATER SAMPLE RESULTS

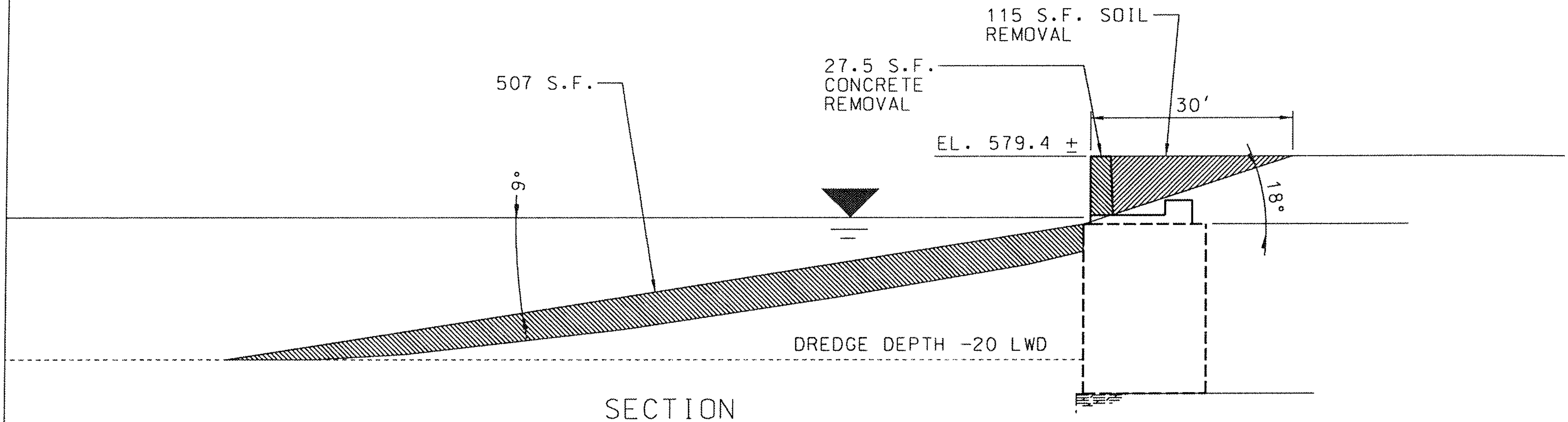
URS

FIGURE 9

J:\35933.00\db\Gis\union.apr GROUNDWATER EXCEEDANCES
4/27/2004

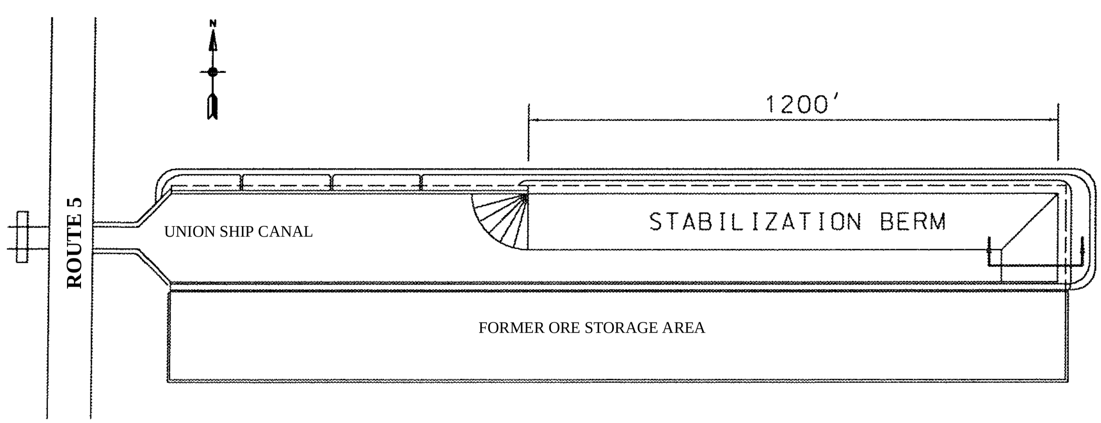
SAND SLOPE STABILIZATION OPTION

REACH D - SOUTH 100 L.F. OF EAST END WALL



SECTION

GENERAL LAYOUT SLOPE STABILIZATION OPTION



NOTES:

1. FILL MATERIAL TO BE CLEAN, DREDGED SAND.
2. SOIL REMOVED SHALL BE DISPOSED OF IN A CONFINED DISPOSAL FACILITY.
3. REINFORCED CONCRETE REMOVED TO BE DISPOSED OF.
4. RIPRAP SLOPE BETWEEN -3 LWD AND +8 LWD.

FIGURE 10

UNION SHIP CANAL
WALL STABILIZATION OPTIONS

DRAWING NOT TO SCALE
ALL ELEVATIONS SHOWN REFERENCE IGLD 1985